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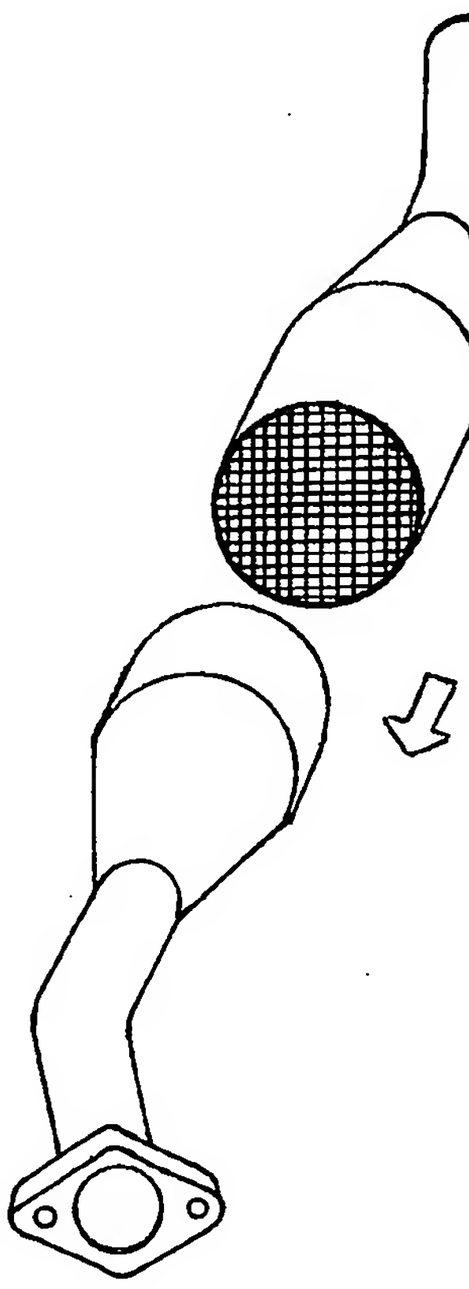
(54) Title: REGENERATION PROCESS FOR CATALYTIC CONVERTERS



(57) Abstract: This invention describes a method of regenerating run-down or no longer efficient catalytic converters consisting in the following process: - cut the converter perpendicularly to its axis in the area where the catalytic unit to be substituted is housed. - empty and clean the internal part of any residue of the catalyst that was inside. - fill the shell with an elical unit without casing, either made of one smooth and one corrugated metal sheet overlapped and wrapped in a coil and treated after or before with washcoat and precious metals. - secure the coiled bands to the shell. - reconstitute the converter by joining and tig/mig welding together the two previously separated parts.

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Declarations under Rule 4.17:

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for the following designation US*

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search report*

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"REGENERATION PROCESS FOR CATALYTIC CONVERTERS. "

DESCRIPTION

This invention describes a method of regenerating run-down catalytic converters.

It's a known fact that cars, industrial vehicles, earthmovers and generally all vehicles with an i. c. engine, are equipped with an exhaust system to eliminate the exhaust fumes, which consists of various parts. In a car for example, the exhaust system is made of:

- an exhaust manifold
- a catalytic converter (which can be linked or not to the manifold)
- the silencer (itself made of different elements)

This invention is only about the catalytic converter.

The vehicles with internal combustion engines are equipped by the manufacturing company with a specific catalytic converter, its characteristics especially depend on the type of engine used.

A catalytic converter is composed of a stainless steel casing, with a steel or cordierite monolith placed inside (catalytic unit), whose use is to destroy the pollutants contained in exhaust fumes.

An example of catalytic unit is described in the patent IT2001A19.

The actual catalytic part, which is enclosed in the steel shell, is linked with welded joints to the rest of the exhaust system (the manifold and the silencer) by fittings, pipes and flange joints, which differ in shape and length.

Each vehicle has its own specific exhaust system and currently there are more than 700 different types of cars, therefore 700 different types of catalysts. To reproduce all the models would be a very costly investment, as they all have to be bought. Each one requires the building of an assembly template and fittings must be recognised and reproduced exactly the same (pipes and flange joints).

To make the models would require an initial investment in equipment plus a further

investment for the parts (semi manufactured) in order to allow for their assembly. If the models are more than 700 the parts to be reproduced will be more than 3000. The logistic effort in managing the stock warehouse of the end products and the semi manufactured ones is enormous!

The regeneration of a used converter currently means the substitution of the catalytic block, that is the substitution of the part of the converter, which houses the monolith. In order to avoid modifying the shape(profile) and form, the operation must be done either with the piece still installed on the vehicle or with the piece locked at the two ends on a clamp template. Using a saw or an abrasive disk the catalytic block made of monolith plus its cone fittings is then cut and substituted with a new ceramic or metallic unit.

Depending on how the work is carried out, the results of the operation may differ. The aesthetic result cannot always be good because the match of the new catalyst isn't always easy, especially when the catalyst and the converter are part of the same block, which may affect its working order.

- a mixed converter is obtained with some original parts and other non-original ones often of inferior quality.
- the cost of the operation is not always convenient and it depends on how complex the converter is to work on; this affects the cost of labour and consequently, the relationship between quality and price suffers.

The aim of this invention is to propose a simple and cheap way of regenerating exhausted converters (in which the catalyst power has been worn out) and to recondition the ones that are no longer efficient (where the internal monolith is broken or non existent).

With reference to the attached figures, by using a saw, the run-down catalyst is sectioned on one side perpendicularly to its axis, in a convenient spot either where the section and the shape of the monolith are even or where it's easier to extract its content (fig 1).

Alternatively you can make a parallel cut to the axis of the area with the widest cross section.

The converter is then emptied completely of its inside components. The ceramic part (the monolith) which may sometimes be broken or partly non existent or the catalytic metallic

part is taken out and sent to be recycled (to re-use the precious metals which are still inside) (fig 2 - 3). The inside part is carefully cleaned of any residue and filled with a new catalytic unit obtained by overlapping and coiling two metal sheets, one smooth and one corrugated, both coated in washcoat and permeated with other noble metals following well-known techniques. (fig 4) A variation on this method could be done by inserting in the casing a coiled unit (starting with) bands treated only with washcoat, which will then be permeated with precious metals.

For reference there is a lot of easily accessible literature about the concept of coiled unit and its preparations.

The new catalyst unit is then fixed to the original casing with a number of pins, rivets, rods or fittings (fig 5). The coiled bands must be prevented from rotating and moving with respect to the converter axis.

Alternatively, once recognized the exact internal form of the casing you can calander a thin steel

plate of the right longitudinal dimension (so as to be compatible with the dimension of the casing) and fill it with a coiled unit starting with smooth and corrugated steel bands treated with washcoat following the procedure illustrated in the patent IT2001A19. In the latter case, the regeneration is done by using a prefabricated catalytic unit which is then inserted in the emptied casing of the original converter and then secured by spot welding it to the casing itself.

Once fitted, if the procedure hasn't initially been carried out on the bands, the new coiled unit has to be permeated with precious metals on the basis of well-known procedures. After the thermal treatment (which is only necessary if the permeating procedure is carried out at this stage), the converter is closed, that means the parts which were separated initially, are joined and welded together. (fig 6 - 7)

The welding can be done either with a continuous electrode welder or with a TIG welder. By using the latter, the aesthetic result will be definitely better as there will be no trace left of the join.

Lastly the converter is finely sanded in order to eliminate the oxide on the surface. This operation is optional and gives back the piece its original shine.
The advantage of this technique is obvious.

There is no need to build templates, specific parts, flange joints or spare parts, because the work is carried out on the original piece which is still in excellent condition as it is made of high quality stainless steel;
- The reconditioning, that is the regeneration of the converter, only requires catalytic bands of standard production (with two or three sizes all converters can be overhauled) or at the most catalytic units of standard form and dimension.
- The reconditioning transforms the original ceramic piece at 400 cpsi (cells per square inch) into a steel indestructible converter, which cannot be broken (while ceramic is very fragile). After all the regeneration with a ceramic monolith is very difficult to carry out and the result is uneconomic as ceramic catalytic units are both rigid and fragile.
- The new catalyst can be made using bands of 400 cpsi but also of 200 and 100 cpsi and generally bands of any number of cells. It is well known that by varying the number of cells the opposite resistance of the catalyser changes when the gases pass through and consequently the engine performance changes. This technique can be favourable also in case of sports cars. It's possible to regenerate the catalyst by either returning to its original operational features or by giving it higher sports specifications in terms of performance.

- By permeating the coiled unit after inserting it into the casing, precious metals are saved, therefore costs are reduced. As the work is being done on bands which have already been treated, loss of material is avoided both during the gauging of the coiled unit to be inserted and during the drilling for the positioning of the pins.
- The process is quick and at the end of the work, if the weld has been done well, there will be no trace of the join. It can also be used for catalysts of any shape (round, oval, trapezoidal etc)

The present invenction is open to many modifications, all of which are a part of the

inventive concept.

Technical details can be substituted by other technically equivalent elements.

Any materials can be used, depending on the requirements, so long as they are compatible with the necessary use.

CLAIMS

1) the regeneration method of run-down or no longer efficient catalytic converters consisting in the following process:

- cut the converter perpendicularly to its axis in the area where the catalytic unit to be substituted is housed, in the spot where the cross section and the shape of the catalyst contained are even.
- empty and clean the internal part of any residue of the catalyst that was inside
- fill the shell with a helical unit without casing, either made of one smooth and one corrugated metal sheet overlapped and wrapped in a coil, or with a new pre-manufactured catalytic unit
- secure the coiled bands to the shell or fix the new pre manufactured unit.
- reconstitute the converter by joining and tig/mig welding together the two previously separated parts

2) regeneration method of catalytic converters according to the previous claim in which you cut the converter to be treated parallel to its axis in the point where the cross section is largest.

3) regeneration method of catalytic converters in accordance with the previous claims in which the coiled bands that form the coiled unit are treated with washcoat and permeated with precious metals both before and after being coiled together and fitted inside the shell.

4) methods of regeneration of catalytic converters in accordance with the previous claims in which the coiled bands that form the coiled unit are first treated with washcoat before being coiled and permeated with precious metals after being fixed in the shell

5) regeneration method of catalytic converters in accordance with previous claims about the converters having catalyst units of any form or dimension.

6) regeneration method as from previous claims in which the overlapped and coiled bands are fixed to the shells with pins, rivets and other fittings.

7) regeneration method of catalytic converters as in previous claims where, by catalytic converter, we mean a device of a generic shape used to purify the pollutant gases produced by i.c. engines.

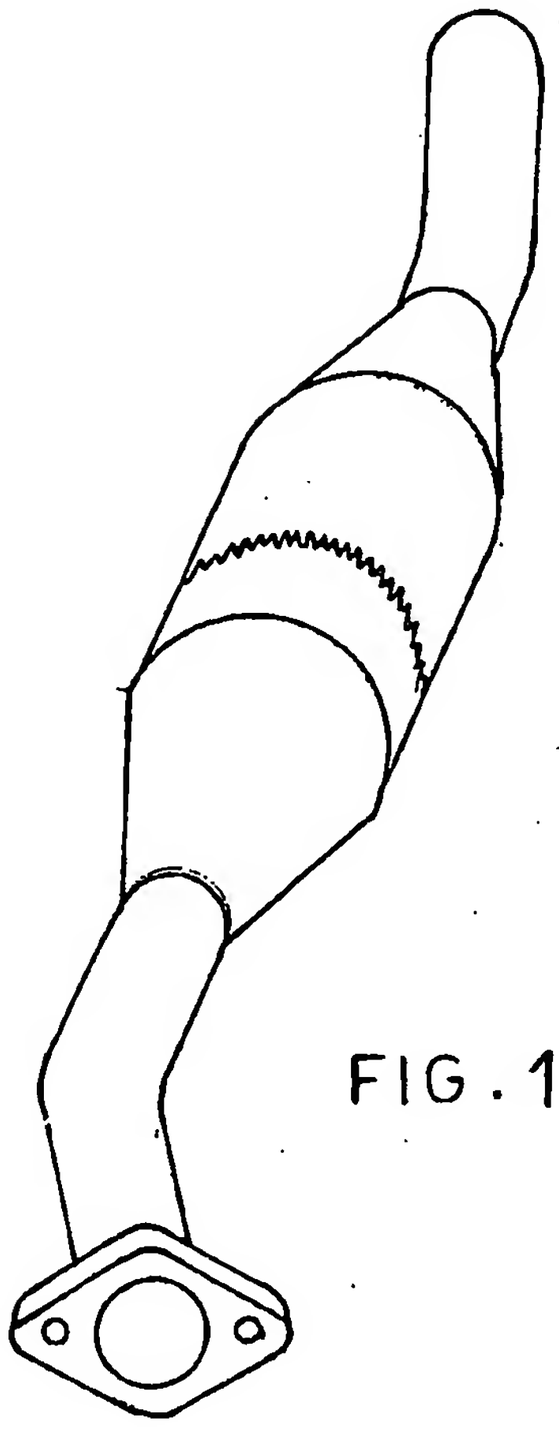


FIG. 1

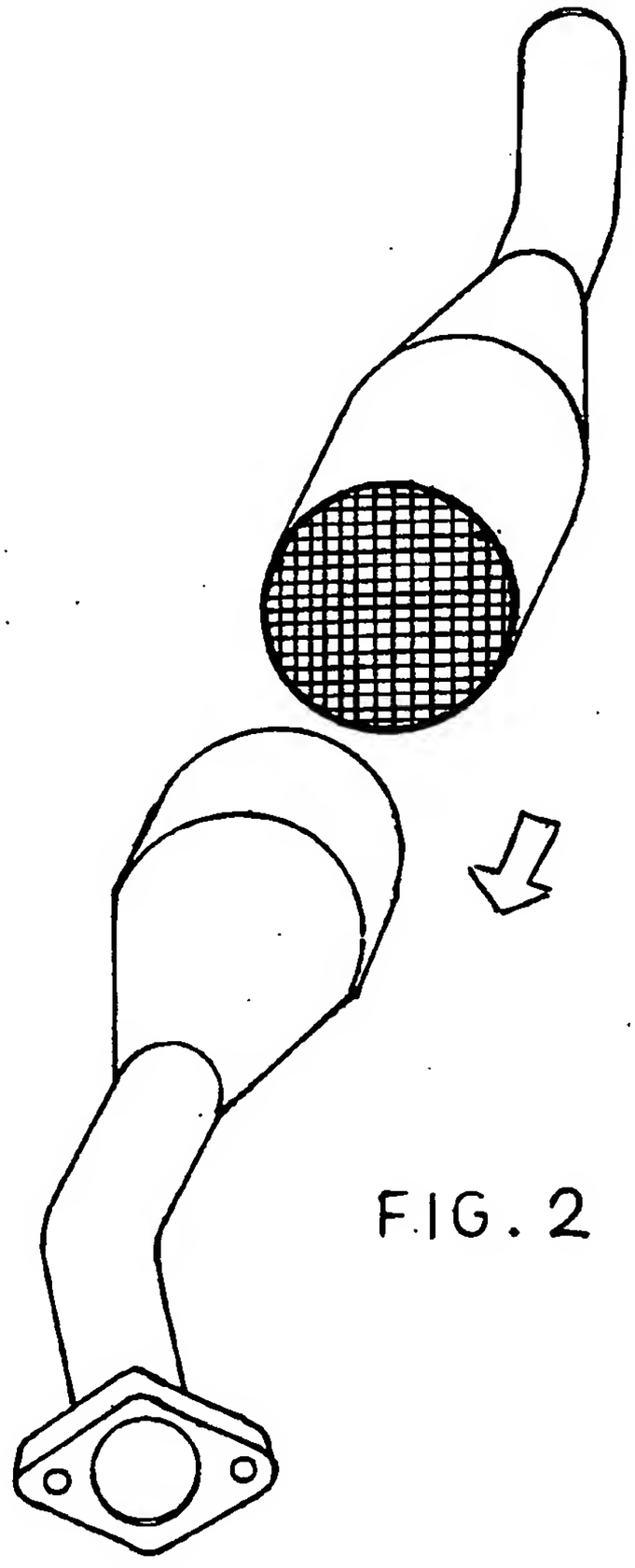
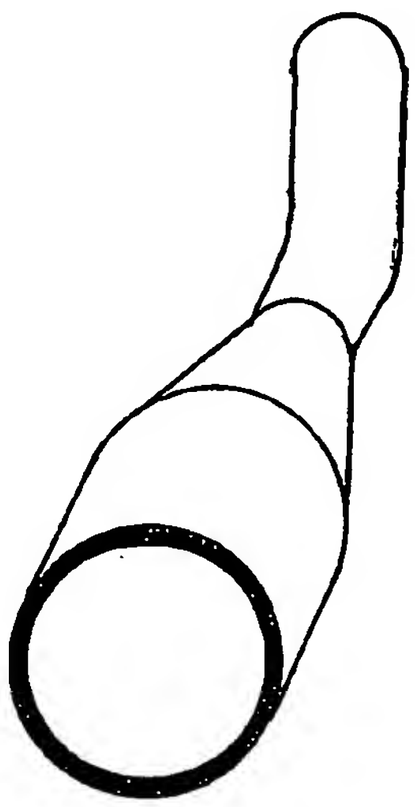


FIG. 2



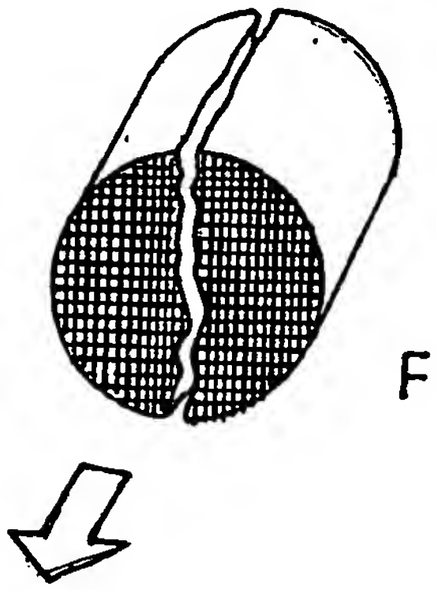


FIG. 3

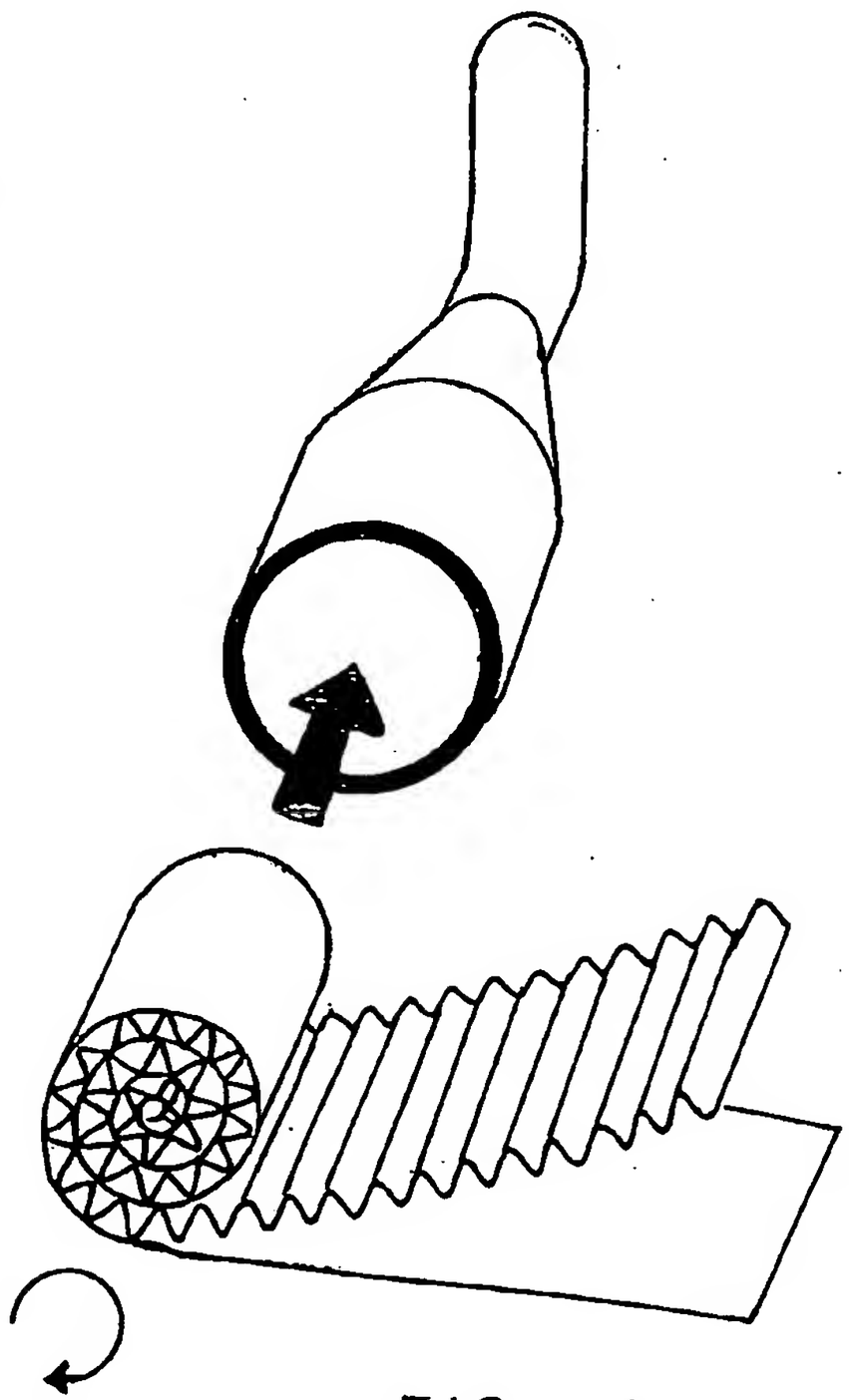


FIG. 4

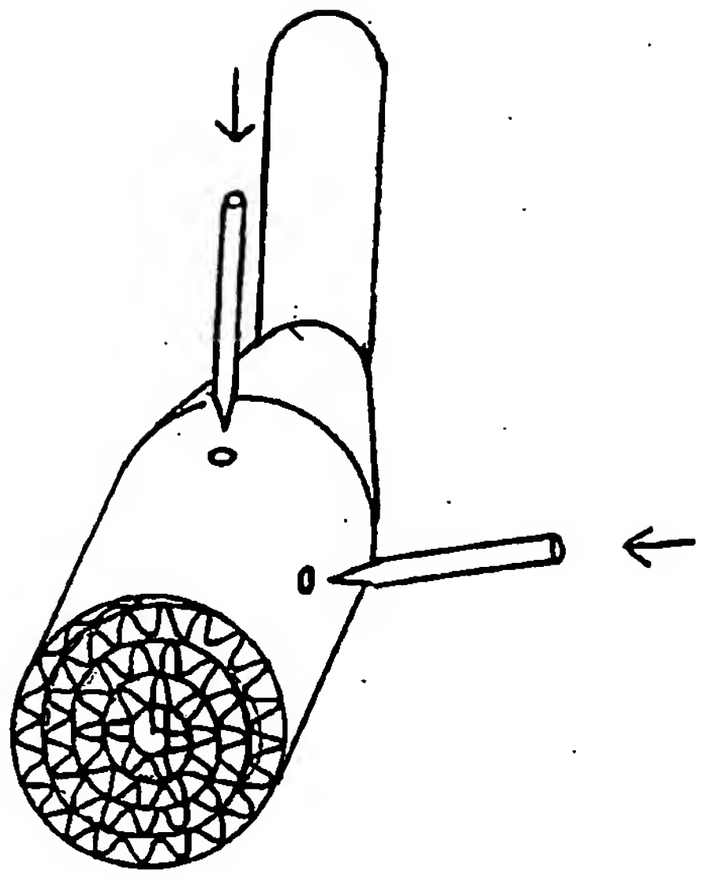


FIG. 5

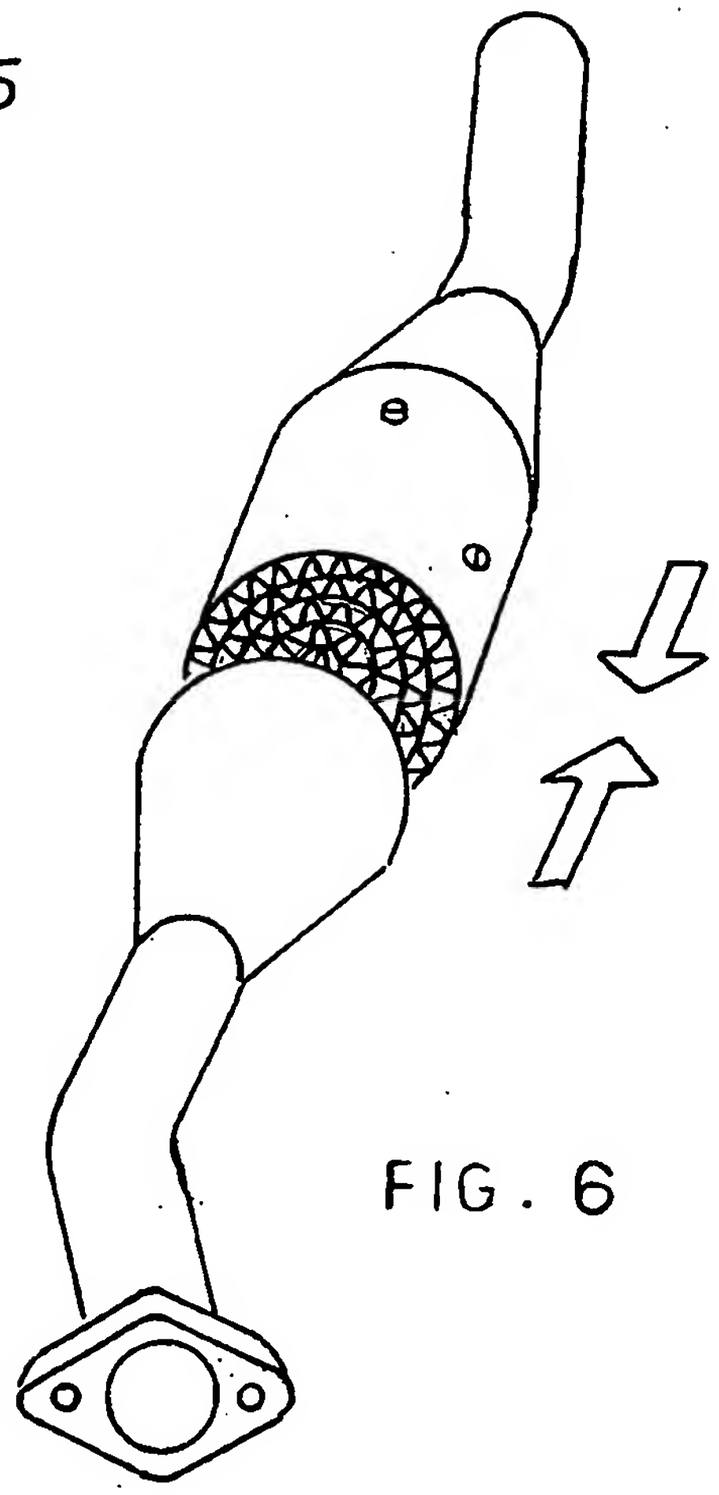


FIG. 6

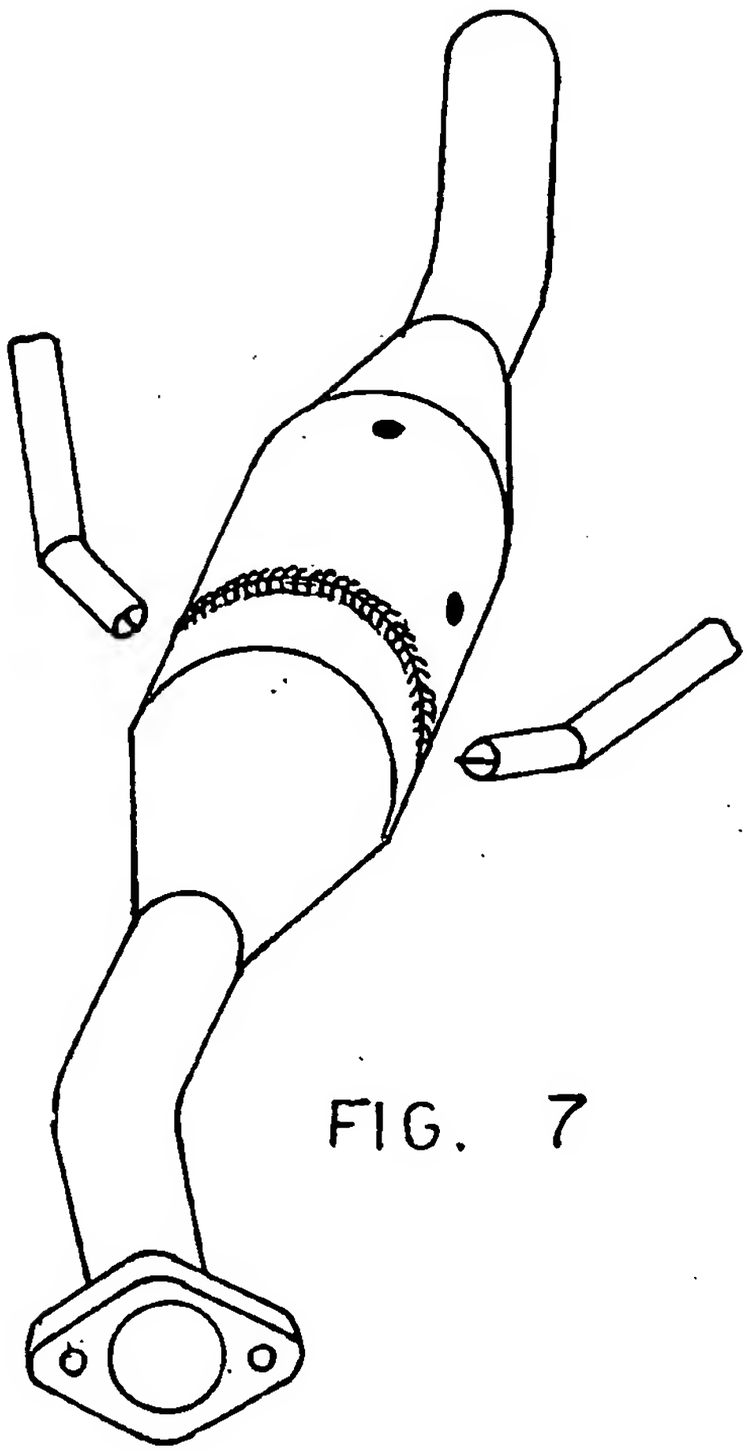


FIG. 7

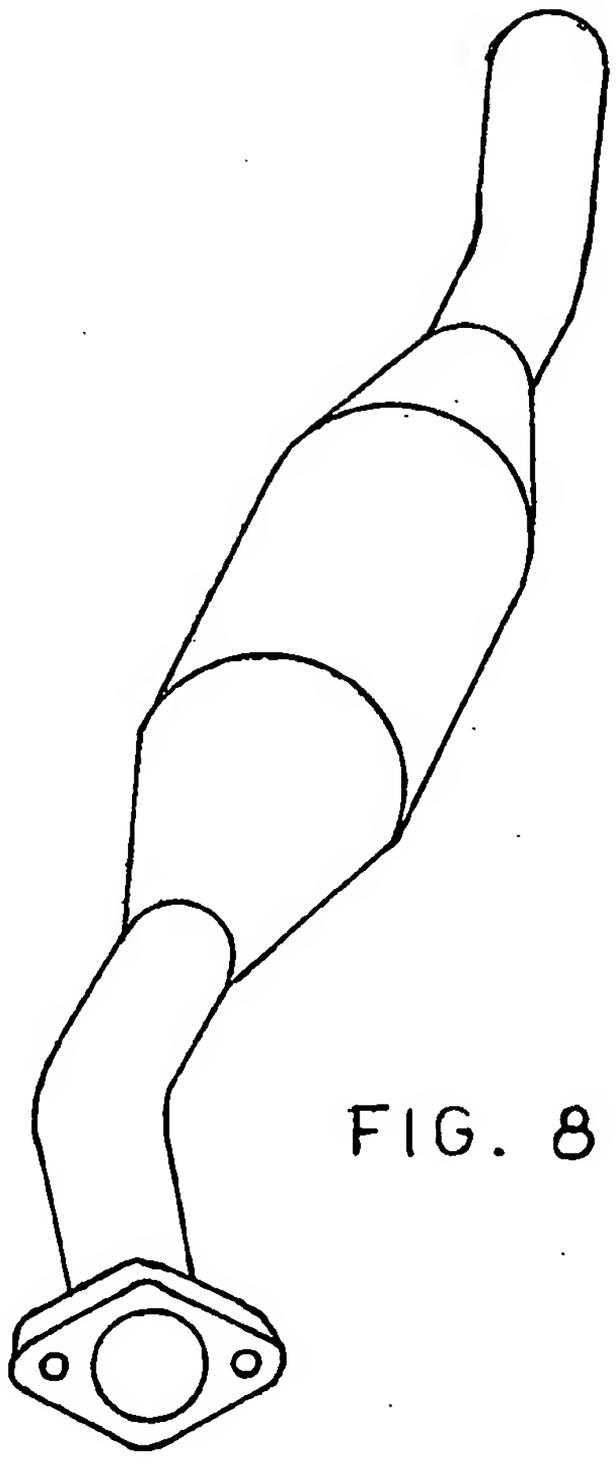


FIG. 8

INTERNATIONAL SEARCH REPORT

ernational Application No
CT/IT2004/000266

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F01N3/00 F01N3/28 F01N7/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 01/96716 A (WEBER THOMAS ;FAURECIA SYSTEMES D ECHAPPEMEN (FR)) 20 December 2001 (2001-12-20) page 4, line 18 -page 5, line 18; figures 1-5 ---	1-7
A	US 3 889 464 A (GARDNER CONRAD O) 17 June 1975 (1975-06-17) column 3, line 29 -column 4, line 13; figures 2-4 -----	1-7

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
25 August 2004	03/09/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Zebst, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

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CT/IT2004/000266

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0196716 A	20-12-2001	FR 2810370 A1	21-12-2001
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